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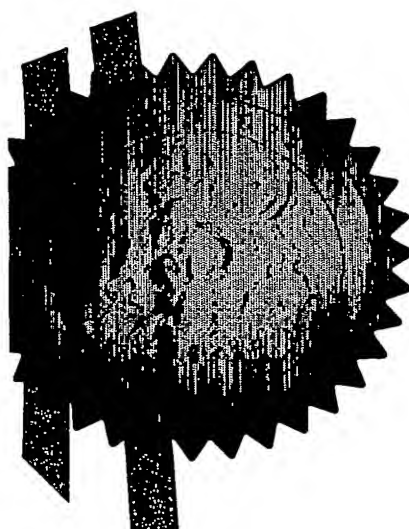
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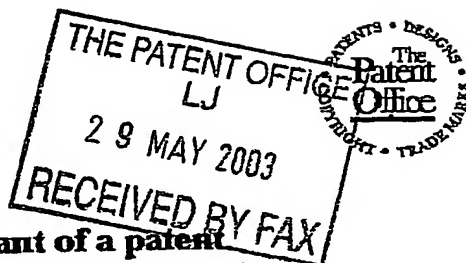
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29 MAY 2003

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1. Your reference

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2. Patent application number

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0312249.6

29MAY03 EB10780-1 010002
POL/7700 0.00-0312249.63. Full name, address and postcode of the or of each applicant (underline all surnames)

Patents ADP number (if you know it)

If the applicant is a corporate body, give the country/state of its incorporation

Spicket Valves and Pumps Limited
Lawpark Farm
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PA13 4TA

8639981001

United Kingdom

4. Title of the invention

Liner retention system

5. Name of your agent (if you have one)

"Address for service" in the United Kingdom to which all correspondence should be sent (including the postcode)

Kennedys Patent Agency Limited
Floor 5, Queens House
29 St Vincent Place
GLASGOW
G1 2DT

Patents ADP number (if you know it)

08058240002 ✓

6. If you are declaring priority from one or more earlier patent applications, give the country and the date of filing of the or of each of these earlier applications and (if you know it) the or each application number

Country

Priority application number
(if you know it)Date of filing
(day / month / year)

7. If this application is divided or otherwise derived from an earlier UK application, give the number and the filing date of the earlier application

Number of earlier application

Date of filing
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8. Is a statement of inventorship and of right to grant of a patent required in support of this request? (Answer 'Yes' if

YES

- a) any applicant named in part 3 is not an inventor, or
b) there is an inventor who is not named as an applicant, or
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Description 12

Claim(s)

Abstract

Drawing(s) 1

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Priority documents

Translations of priority documents

Statement of inventorship and right to grant of a patent (Patents Form 7/77)

Request for preliminary examination and search (Patents Form 9/77)

Request for substantive examination (Patents Form 10/77)

Any other documents
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11.

I/We request the grant of a patent on the basis of this application.

Signature

KENNEDYS

Date

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12. Name and daytime telephone number of person to contact in the United Kingdom

Arlene Campbell TEL: 0141 226 6826

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Patents Form 1/77

1 Liner Retention System

2

3 This present invention relates to apparatus for aligning
4 and securing cylinder liners to pumps and in particular;
5 though not exclusively, to apparatus for aligning and
6 securing cylinder liners of reciprocating pumps to their
7 respective pumping modules.

8

9 In the past, there have been several different types of
10 ways to attach cylinder liners to their respective
11 pumping modules and these may vary according to make of
12 pump in which they are used. One embodiment presently
13 known employs a tapered concentric clamp, while another
14 uses a concentric screw clamping arrangement.

15

2

1 It is important that the means for aligning and securing
2 the cylinder liners may be implemented without undue
3 effort and down-time. Cylinder liners are required to be
4 changed frequently and this causes considerable
5 inconvenience if the means and method for releasing the
6 old cylinder liners and fitting the replacement cylinder
7 liners are slow or difficult to operate. It has been
8 found that original pump manufacturers' systems or means
9 for securing cylinder liners to respective pumping
10 modules have been difficult to operate for a plurality of
11 reasons, including the involvement of heavy components,
12 the handling of which may be dangerous for operators.
13 These systems also require considerable strength, skill
14 and reliability of operators, together with the use of
15 heavy tools in confined spaces. Yet further, the securing
16 force is dependent on the extent of wear and the general
17 condition of a plurality of the securing components.
18
19 US RE37,483 has overcome some of these problems in
20 providing an apparatus for securing a cylinder liner to a
21 pumping module in a reciprocating pump which has a set of
22 arrangements each with a hydraulically activated piston,
23 a rod attached to the piston which is adapted to receive
24 a nut, the retraction of which forcibly compels in
25 attraction against a spring, the cylinder liner and the

3

1 pumping module. In particular, this apparatus provides a
2 tool which can be operated by hand. A further advantage
3 is that the tool uses components which are considerably
4 lighter than those of the prior art to ease handling.

5

6 However, excepting the nuts and clamping ring, the
7 assembly of the apparatus must be completed prior to
8 lifting and positioning on the pumping module. Thus
9 although the individual components may be comparatively
10 lighter, the combined weight of the assembled apparatus
11 makes it difficult to handle.

12

13 It is an object of the present invention to provide a
14 liner retention tool which mitigates at least some of the
15 problems of the prior art.

16

17 According to a first aspect of the present invention,
18 there is provided an apparatus for securing a cylinder

19 liner to a pumping module, the apparatus comprising one

20 or more arrangements each fastened to said pumping
21 module, each arrangement comprising a housing including a
22 piston, the piston acting on a tension plate, the tension
23 plate having a stud rod extending therefrom through the
24 housing at an end distal to the pumping module and
25 thereon passing through a respective aperture in a

4

1 clamping member adapted to grip the cylinder liner, the
2 rod having a first portion substantially surrounded in an
3 elastomeric member and a second portion threaded to
4 receive a nut, wherein initial compression of the
5 elastomeric member by the tension plate and tightening of
6 the nut toward the pumping module, followed by release of
7 the elastomeric member forcibly compel the cylinder liner
8 towards the pumping module.

9
10 Preferably the elastomeric member comprises a multi-layer
11 structure having layers of flexible material interleaved
12 with layers of strengthening material. The flexible
13 material may be a rubber or the like. The strengthening
14 material may be a metal, composite or other known
15 material having a relatively high Young's modulus.

16
17 Preferably the housing comprises at least two parts, a
18 first part including the piston and a second part
19 including the tensioning plate, rod and elastomeric
20 member wherein the parts are separable for assemble and
21 disassembly.

22
23 Preferably the/each piston is a hydraulic piston. More
24 preferably the piston and a base of the housing define a
25 space for accommodating hydraulic fluid.

1
2 Preferably also there are four arrangements arranged
3 equidistantly around and externally of a circumference of
4 the cylinder liner.

5
6 Preferably the clamping member comprises a clamping ring
7 including the apertures for receiving the stud rods.

8
9 According to a second aspect of the present invention
10 there is provided a method of securing a cylinder liner
11 to a pumping module of a pump, the method comprising the
12 steps:

- 13
- 14 (a) locating a first part of a housing including a
15 piston onto the pumping module;
 - 16 (b) locating in a second part of a housing including an
17 elastomeric unit and a stud bolt having a tension
18 plate attached thereto, onto the first part;
 - 19 (c) fastening the housing to the pumping module;
 - 20 (d) locating the cylinder liner against a seal on the
21 pumping module;
 - 22 (e) placing a clamping ring over the cylinder liner;
 - 23 (f) inserting the stud bolt through an aperture in the
24 clamping ring;

6

- 1 (g) placing a nut on a threaded portion of the stud bolt
2 and locating the nut against the clamping ring;
3 (h) actuating the piston against the tension plate to
4 compress the elastomeric member and force the stud
5 bolt through the aperture;
6 (i) at full compression, tightening the nut against
7 the clamping ring; and
8 (j) releasing the piston and by the expansion of the
9 elastomeric member thereby sealing the cylinder
10 liner to the pumping module.

11

12 The method may include the step of pumping hydraulic
13 fluid to the piston to actuate the piston.

14

15 An example embodiment of the invention will now be
16 described by way example only, with reference to the
17 accompanying Figures, in which:

18

19 FIG. 1 is a cross-sectional view of an apparatus
20 according to the present invention mounted on a pumping
21 module with a cylinder liner.

22

23 A reciprocating pump generally described at 1 comprises a
24 module 2 and cylinder liner 3. It is desirable that the
25 cylinder liner 3 is securely held up against the face 4

7

1 of the module 2. Between the cylinder liner 3 and the
2 module 2 there is provided a seal 5 which, in its
3 unenergized (i.e., uncompressed) state, must be
4 compressed by the cylinder liner 3 to close a gap created
5 between the adjacent faces of the module 2 and cylinder
6 liner 3.

7

8 In order to prevent the existence of this gap, it is
9 necessary to forcibly push the cylinder liner 3 against
10 the module 2 and this is achieved by securing means,
11 generally described at 6. The effect of compressing the
12 cylinder liner 3 against the face 4 of the module 2 is to
13 energise or compress the seal 5. This compression is of
14 course desirable to increase the effectiveness and
15 efficiency of the seal 5. The securing means 6 comprises
16 one or more assemblies or arrangements 20. Each assembly
17 comprises a housing 7. The housing has three parts
18 abutted together; a first part 16, integral with a
19 baseplate 9, located against the pumping module 2; a
20 second part 17, the central portion, located against the
21 first part; and a third part 20 located at an end distal
22 to the pumping module 2 and abutted to the second part
23 17.

24

8

1 The first part 16 houses a piston 8 which is
2 hydraulically operated by the insertion of hydraulic
3 fluid into a space 23 between the base of the piston and
4 the rear face of the housing. In this way piston 8 may
5 travel into the second part 17. The first part 16 is
6 integral with the baseplate 9. The second part 17 is a
7 cylindrical body into which is located an elastomeric
8 member 10 and a stud bolt 11. The elastomeric member 10
9 has a cylindrical body and a bore passing therethrough.
10 The elastomeric member 10 is made up of layers of a
11 flexible material e.g. rubber and a strengthening
12 material e.g. metal arranged perpendicular to the bore.
13 The rod 11 has a tension plate 15 attached to one end and
14 has a threaded portion 21 on the opposing end. The rod 11
15 is located through the bore of the elastomeric member 10
16 and extends from the housing away from the pumping module
17 2. Tension plate 15 has a circular face arranged to abut
18 the piston 8 and an annular face arranged to abut a
19 bottom face of the elastomeric member 10. The third part
20 23 of the housing 7 is a top cover plate having an
21 aperture through which the rod 11 passes.
22
23 On exiting the housing 7 the rod passes over a lug 14
24 located on the cylinder 3 and through an aperture in a
25 clamping ring 13 arranged around the cylinder. The

9

1 threaded portion 21 of the rod 11 extends beyond the
2 clamping ring 13 and a nut 12 is placed thereon.

3

4 In the embodiment shown, the securing means 6 includes
5 one or more of arrangements 20 having the aforementioned
6 components 7,8,10,11,12 and 15. The arrangement is
7 permanently bolted by bolts 22 to the module 2, although
8 the nuts 12 are detachable, thereby allowing removal of
9 the cylinder liner 3.

10

11 Advantageously in assembling the securing means 6 to the
12 pumping module 2, the baseplate 9 with the first part 16
13 of the housing can be separated from the remaining
14 components of the housing. The remaining components can
15 all be assembled individually. This reduces the need to
16 manhandle heavy pre-assembled parts onto the pumping
17 module 2.

18

19 In use, when a cylinder liner 3 is positioned against or
20 nearly against the module 2, the shoulder or clamping
21 ring 13 is then fitted over each of the stud rods 11. The
22 nuts 12 are then threadably applied to the rods 11. The
23 method of forcibly securing the cylinder liner 3 to the
24 pumping module 2 is then implemented. This involves
25 inserting hydraulic fluid into the space 23 between the

10

1 head of piston 8 and the baseplate 9, such that the
2 elastomeric unit 10 is compressed and rods 11 are
3 extended to a greater outwith the top plate 23 of the
4 housing 7 and the nut 12 is given freedom to be tightened
5 by further rotation along rod 11 towards the clamping
6 ring 13 simultaneously. The hydraulic fluid is then
7 released from the space 23 so that the piston 8 retracts
8 towards the module 2 and the elastomeric member 10
9 expands. The cylinder 3 is then secured against the
10 module 2.

11
12 Preferably, the process of tightening the nuts 12 while
13 compressing the elastomeric units 10 should be carried
14 out sequentially around the arrangements 20. It should be
15 noted that the apparatus and method described herein
16 allows the nuts 12 to be tightened with light hand tools.
17 It will be appreciated that this is a considerable
18 advantage over the requirement of using heavy tools which
19 was, in the past, required.

20

21 The invention thus provides components which are
22 considerably lighter than comparative components used
23 heretobefore. In view of negating the requirement of
24 heavy tooling or handling, the components are less likely
25 to be damaged during the removal or securing of cylinder

11

1 liners and thus the invention permits greater
2 repeatability and reliability. Furthermore, the need for
3 intensive manual or skilled by operators is also
4 mitigated. Similarly, there is a reduced danger of injury
5 to operators or by-standers during such operational and
6 maintenance functions.

7

8 It will also be appreciated that, because the apparatus
9 can be readily dismantled into easily manually
10 transportable components, installation in difficult
11 locations can be safely carried out without the need for
12 heavy lifting equipment. It is a feature of the invention
13 that, by varying the composition and construction of the
14 elastomer unit 10, a very wide range of operating duties
15 can be met allowing accurate matching to each
16 application.

17

18 Further modifications and improvements may be
19 incorporated without departing from the spirit or scope
20 of the invention. For example, though the invention has
21 particular relevance to reciprocating pumps such as oil-
22 field mud pumps, the invention is not, however, limited
23 to mud pumps but finds application in a variety of
24 reciprocating or positive displacement pumps.
25 Additionally, though the clamping ring in the embodiment

12

- 1 described abuts a lug on the cylinder, cylinders without
- 2 lugs may also be used with the invention.
- 3

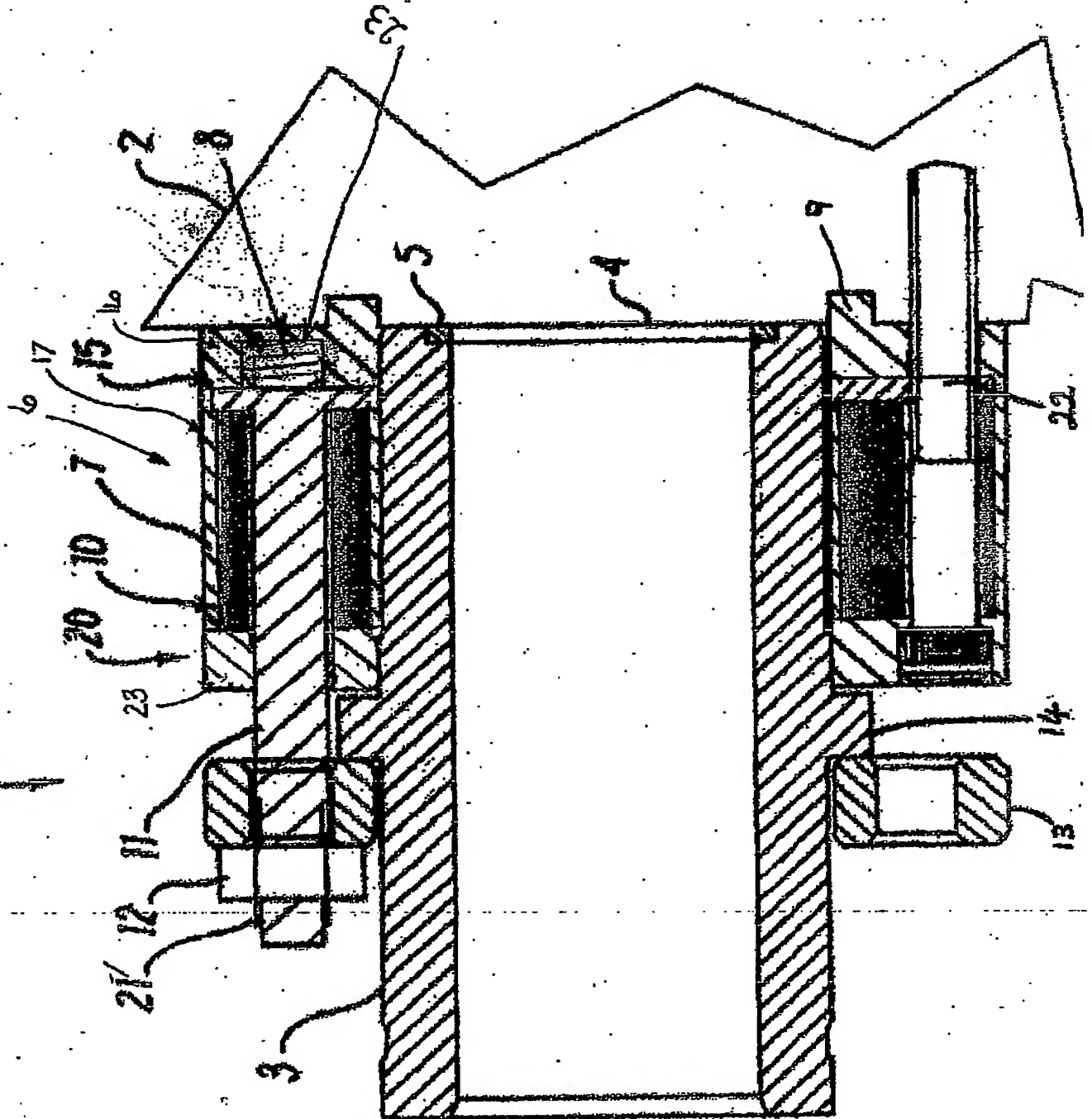


FIGURE 1

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